Environment Canada

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Western and Northern Region

Région de l'Ouest et du Nord

Environmental Protection Service

Service de la protection de l'environnement

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WINNIPEG VEHICLE EMISSION TEST PROGRAM - 1986

by

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W&NR 86/87-CP(EP)-8

Environmental Protection
Manitoba District
Conservation and Protection

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1986 WINNIPEG VEHICLE EMISSION TEST PROGRAM

1. Introduction

As part of Canadian Environment Week activities, a vehicle emission test clinic was held in Winnipeg on June 2-5, 1986. The clinic was sponsored and conducted by Environment Canada and Manitoba Environment and Workplace Safety and Health. Three staff members from the EPS Manitoba District Office and two from Manitoba Environment participated, with assistance provided on one of the days by the shop foreman from Midway Chrysler Ltd. Participation in the clinic by motorists was voluntary.

The purpose of the clinic was to gather information on the emission levels of carbon monoxide and hydrocarbons from in-use motor vehicles, to identify the extent of tampering with pollution control devices, and to promote an awareness amongst motorists and the public-at-large of the importance of motor vehicles as a source of air pollution.

Previous test clinics had been held in Winnipeg in 1979 and 1983, as well as in various other Canadian cities since 1974. Other test clinics were held concurrently in several Canadian cities during the week of June 2, 1986.

2. Clinic Location and Set-up

Grant Park Shopping Plaza was selected as the site of the test clinic. The plaza is centrally located, offers good access via a service road in front of the plaza, and has sufficient room available without interfering with other traffic in the plaza.

A 6.2 x 6.2 metre tent was rented and set up adjacent to a light pole which had been fitted with a 110-volt, 15-amp outlet. Traffic barricades and pylons were borrowed from the City of Winnipeg and used to cordon off an area approximately 50 x 50 metres. Pylons were used to delineate a single S-shaped lane leading to the tent. The traffic lane held five to six cars within the barricaded area.

A van was used to house the equipment overnight at the site, and on-site, night-time security was contracted through a local security service.

3. Hours of Operation

The clinic was operated from noon to 5 p.m. on June 2 (to allow for set-up of the tent and equipment in the morning) and from 9 a.m.-4 p.m. on June 3-5.

Vehicles were stopped at the entrance to the clinic at the advertised closing times, but about one more hour was required to test and inspect the vehicles remaining within the barricaded area.

The clinic was operated for a total of 30 hours.

4. Advertising and Media Coverage

A single newspaper ad (Appendix A) was placed in the May 31 edition of the Winnipeg Free Press. Thirty-second radio announcements were run several times a day on CKY and CJOB radio stations, during June 1-4. A press release was also sent out to local radio, TV and newspaper offices on May 29. Copies of the radio ads and press release are contained in Appendix 1.

A 1.5 x 3 metre mobile sign announcing the test clinic dates and hours was rented and placed at Grant Park Plaza.

One local radio station sent a reporter to the test clinic on opening morning to have its vehicle tested and to interview the staff. There was TV coverage of the clinic on CKND TV on the evening of June 2, including an interview with staff. There was no formal opening event for the test clinic.

5. Testing Procedures

Vehicle owners were greeted near the entrance to the clinic by a traffic controller who explained the purpose and procedures. Hand-out information on vehicle emissions was distributed, and the approximate waiting time was given. The traffic controller screened out any vehicles with serious exhaust leaks or diesel engines, and

any obvious oil burners or those with spark arrestor screens in the tail pipe that the owner did not wish to have removed by the test crew.

A team of two people then collected information on vehicle make, age, mileage, and engine size as well as information on presence of fuel labels, proper filler caps, and exhaust integrity. A standard survey form prepared by EPS Ottawa was used (Appendix B).

Exhaust emissions were then measured by a second, two-person team using a Sun Electric Corp. two-gas emission tester (EPA 75 model). An induction pick-up tachometer was installed on a spark plug lead, and hydrocarbon (HC) and carbon monoxide (CO) levels were determined at 2500 rpm (after allowing the engine to run for 30-60 seconds at 2500 rpm) and then at idle. Idle rpm was also noted on the survey forms.

Visual inspections and, where possible, brief function tests of pollution control devices were made, and obvious deficiencies or malfunctions were noted. The owners were then given a sheet (Appendix D) showing whether the emissions at idle were judged to be low, medium or high. Emissions were indicated as being low for those values up to twice the guideline numbers for the appropriate vehicle age (see Appendix C), medium for values 2-3 times the guideline levels, and high for values more than 3 times the guideline.

The vehicle owners often had questions about vehicle problems

they were experiencing, and these were answered where possible. Minor repairs were made to a few vehicles that had obvious problems, such as leaking fuel lines, disconnected spark plug wires and disconnected hoses. No carburetor adjustments were attempted.

6. Survey Results

6.1. Emission Levels

Over the three and one-half days, 222 vehicles were tested and inspected at the clinic. The results shown in Table 1 indicate that 64% of the vehicles tested had idle CO levels lower than the guidelines for the appropriate year vehicle. Eighty-six percent of the vehicles were found to be within the HC guideline values. These guideline values were suggested by EPS Ottawa and are shown in Appendix C.

Results of the tests done at 2500 rpm, as shown in Table 2, indicate that 78% of the vehicles were within the CO guideline, and 97% within the HC guideline. Emissions at 2500 rpm are typically lower than at idle because engines operate more efficiently in the off-idle position.

The average idle and 2500 rpm CO and HC emissions for vehicles by model year are shown in Table 3. Although the data may not be statistically valid for some model years because of the small number of samples, there appears to be a definite increase in idle CO levels

TABLE 1

EMISSION LEVELS AT IDLE

Model Year	No. of Vehicles with: Carbon Monoxide Levels Less Than G/L*	1-2x G/L	2-3x G/L	>3x G/L	Hydrocarbon Levels Less Than G/L	1-2x G/L	2-3x G/L	>3x G/L
1986	8	-	-	-	8	-	-	-
1985	19	-	2	-	19	2	-	-
1984	12	1	3	-	15	1	-	-
1983	10	1	1	-	10	2	-	-
1982	13	3	-	2	16	1	-	1
1981	14	1	4	-	15	3	1	-
1980	15	3	4	2	19	4	1	-
1979	6	2	1	-	7	2	-	-
1978	12	7	1	-	17	3	-	-
1977	13	4	1	1	18	1	-	-
1976	6	4	2	1	10	3	-	-
1975	4	4	4	-	11	1	-	-
1974	2	2	2	-	5	-	1	-
1973 & older	9	14	2	-	21	3	-	1
TOTAL	143	46	27	6 (222)	191	26	3	2 (222)
% of TOTAL	64	21	12	3	86	12	1	1

* G/L = guideline (see Appendix C)

TABLE 2

EMISSION LEVELS AT 2500 RPM

	No. of Vehicles with:							
	Carbon Monoxide levels				Hydrocarbon Levels			
Model Year	Less Than G/L*	1-2x G/L	2-3x G/L	>3x G/L	Less Than G/L	1-2x G/L	2-3x G/L	>3x G/L
1986	3	3	-	1	7	-	-	-
1985	16	2	2	-	20	-	-	-
1984	12	2	-	-	13	1	-	-
1983	6	2	2	2	11	1	-	-
1982	12	3	1	1	16	1	-	-
1981	11	4	2	-	17	-	-	-
1980	19	3	1	-	23	-	-	-
1979	6	1	-	-	7	-	-	-
1978	20	-	-	-	19	-	1	-
1977	16	2	-	-	18	-	-	-
1976	8	2	-	-	10	-	-	-
1975	10	2	-	-	12	-	-	-
1974	3	1	1	-	4	-	-	1
1973 & older	18	3	1	1	22	1	-	-
TOTAL	160	30	10	5 (205)	199	4	1	1 (205)
% of TOTAL	78	15	5	2	97	2	.5	.5

* G/L = guideline (see Appendix C)

TABLE 3

EMISSION LEVELS BY MODEL YEAR

Model Year	No. of Vehicles Tested		Ave. CO (%)		Ave. HC (ppm)	
	Idle	2500 RPM	Idle	2500 RPM	Idle	2500 RPM
1986	8	7	0.16	1.50	86	101
1985	21	20	0.66	.70	164	98
1984	16	14	1.42	.54	197	99
1983	12	12	0.78	1.99	242	179
1982	18	17	1.89	1.32	281	129
1981	19	18	1.73	1.32	318	128
1980	24	23	2.08	1.00	325	134
1979	9	7	2.09	.78	323	151
1978	20	19	2.24	.54	282	158
1977	19	18	1.71	.62	417	126
1976	13	10	3.23	.93	413	154
1975	12	12	3.46	.92	342	131
1974	6	5	3.90	2.47	478	551
1973 & older	25	23	4.05	2.23	611	270
TOTAL	222	205	-	-	-	-
AVERAGE	-	-	2.10%	1.15%	315 ppm	157 ppm

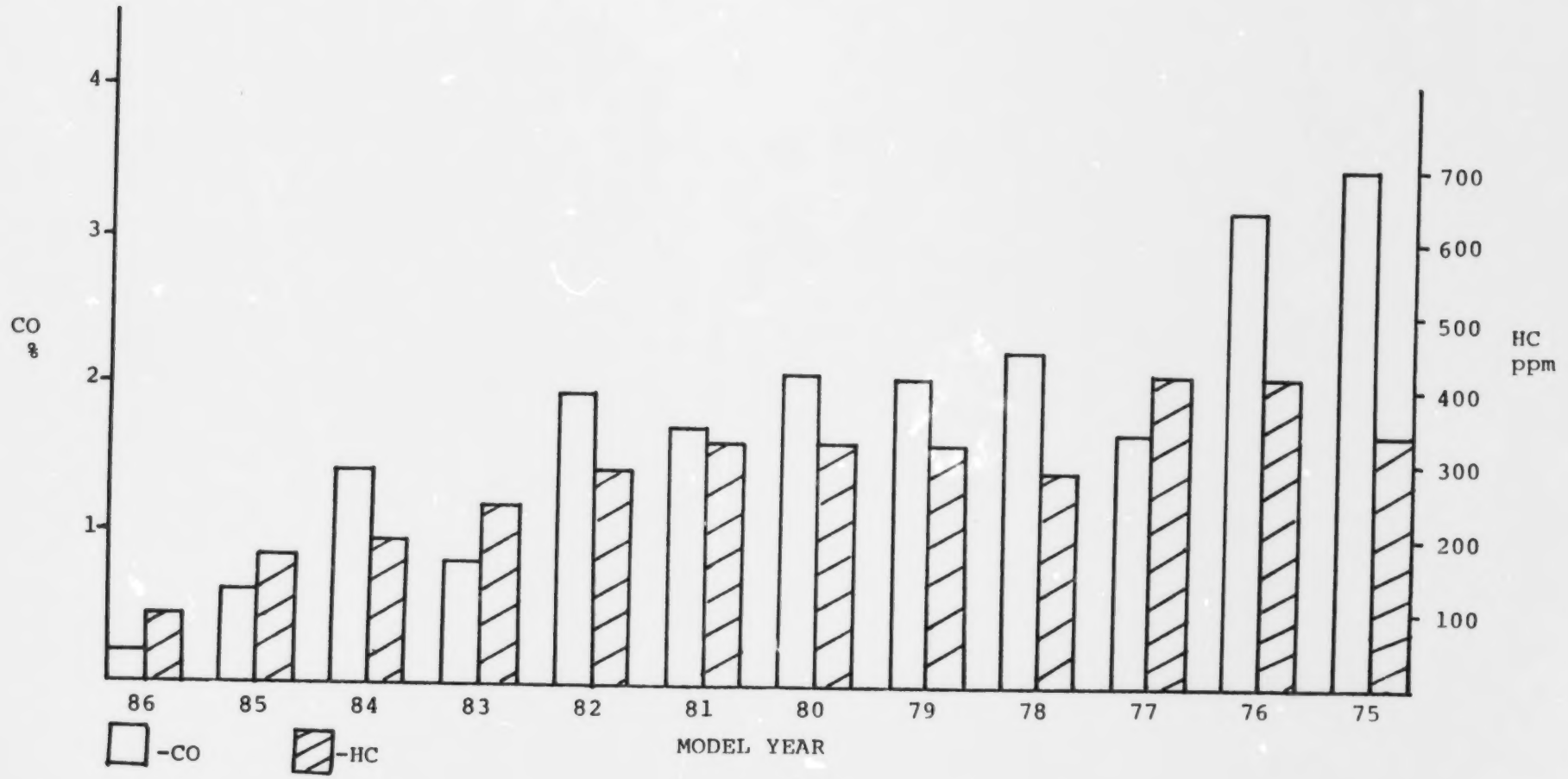
with age. High CO levels are generally a result of partically burned gasoline due to rich air/fuel mixtures from improper carburetor idle mixture settings, dirty air filters, faulty PCV valves or internal carburetor problems. Hydrocarbon levels at idle tended to level off somewhat for vehicles older than 1981 (Figure 1). High hydrocarbon emissions generally occur because of unburned gasoline escaping into the exhaust system. Causes can include: ignition system problems involving the distributor, spark plugs, and ignition timing; or misfires resulting from idle mixtures that are too lean.

The CO emissions at 2500 rpm for 1986 and 1985 vehicles were surprisingly high. Some of these high readings may be as a result of "pattern failures" that have shown up in emission testing programs in the U.S.[1] These "failures" have been attributed to either malfunctioning emission control devices (Type I failure), or to the design of the emission control systems (Type II failure), involving computer control systems in particular.

HC emissions at 2500 rpm were fairly consistent from one year to the next, even for vehicles up to 10 years old. Emission levels rose somewhat for 1974 and earlier models, because increased engine wear in older vehicles results in higher HC emissions. The high average HC value for the 1974 model year was due to the small sample number, and the excessive emissions of one particular vehicle that had a high-speed misfire. The average value without including this vehicle would have been about 190 ppm.

FIGURE 1

CO AND HC EMISSIONS VS MODEL YEAR



6.2 Tampering

Results of inspections of pollution control devices are shown in Tables 4 and 5. The tampering rate was found to increase with age and, as shown in Table 5, the most frequent type of tampering involved the removal of idle mixture screw limiter caps or sealed plugs on carburetors. Although considered to be a form of tampering, the removal of caps or plugs will not necessarily result in increased emissions, depending on the final setting of the idle mixture screws. However, in most cases the mixture setting will have been richened to allow for smoother engine idle, resulting in higher CO emissions.

Disconnection or removal of the air injection system was the second most common type of tampering, followed closely by removal or disablement of the catalytic converter. The air injection system is often seen by motorists as a drain on engine power, so it is often disconnected completely, or not repaired in the event of a malfunction. Broken belts on air pumps are often not replaced. Catalytic converters are removed to allow for the use of cheaper leaded fuel, or are disabled by poisoning with leaded fuel.

Other forms of tampering were observed to be quite low. This may be a result of motorists not understanding or knowing about the function or location of these devices, or because their operation is not considered to affect vehicle performance or fuel economy. It should be noted that actual tampering or malfunction rates may be

TABLE 4

TAMPERING SURVEY RESULTS

Model Year	No. of Vehicles: Inspected	Tampered with or Malfunctioning	% Exhibiting Tampering
1986	8	1	13
1985	21	1	5
1984	16	3	19
1983	12	1	8
1982	18	4	22
1981	19	4	21
1980	24	17	71
1979	9	4	44
1978	20	13	60
1977	19	13	68
1976	13	9	69
1975	12	8	67
1974	6	2	33
1973 & older	25	6	24
TOTAL	222	86	-
AVERAGE	-	-	38%

TABLE 5

TYPES OF TAMPERING OBSERVED

Pollution Control Device	No. of Vehicles Equipped	No. of Disconnections	No. of Apparent Malfunctions	%
Carburetor Idle Limiters/Sealed Plugs	191	63	-	33
Air Injection System	71	13	-	18
Catalytic Converter	142	19	4*	15
Fill Pipe Restrictor	146	10	-	7
Evaporative Canister	202	4	6	5
Thermostatic Air Cleaner	213	5	3	4
EGR Valve	182	3	2	3
PCV Valve	222	2	2	2

* Leaded gasoline being used

higher than those shown in Tables 4 and 5, since it was not possible to perform actual function tests on most of the devices because of time and equipment constraints, and lack of technical data on specific vehicle models. In most cases, a device was deemed to be functional if it was properly installed, and hoses, electrical and vacuum connections appeared to be satisfactory and intact. EGR valves, PCV valves and vacuum motors on the thermostatic air cleaners were checked where possible by activating the devices or disconnecting them and observing their operation or effect on engine operation.

6.3 Comparison with Previous Test Clinic Results

As mentioned earlier, test clinics had been conducted in Winnipeg in 1979 and 1983. Unfortunately, a comparison of "pass/fail" rates with those from previous emission testing clinics was not possible because the criteria used for acceptable versus not acceptable readings for earlier clinics were not reported. It is expected, however, that the criteria used previously were more stringent, since the percentages of vehicles above the specifications were substantially higher. Comparison of average CO and HC values at idle indicates that there has been an improvement in emissions from in-use vehicles. Comparative data are summarized in Table 6. In 1979, the average idle CO level was 2.9%, while hydrocarbons averaged 378 ppm.[2] Average values for 1986 (Table 2) were 2.1% CO and 315 ppm HC, which represent decreases of 28% and 17%, respectively, from 1979. CO emissions at 2500 rpm showed a modest increase from 0.93% to 1.15%, but HC emissions were 28% lower.

TABLE 6

COMPARISON OF WINNIPEG TEST CLINIC RESULTS

	1986	1983	1979
Idle CO (%)	2.1	3.05	2.9
2500 RPM CO (%)	1.15	N/A	0.93
Idle HC (ppm)	315	N/A	378
2500 RPM HC (ppm)	157	N/A	218
Tampering Rates (%)			
- Catalytic Converters	15	2	N/A
- EGR Valves	3	19	N/A
- Sealed Carburetors	33	28	N/A

N / A = not available

In 1983, it was found that average CO at idle was 3.05%[3]. Hydrocarbon levels were not reported. The CO results for 1986 represent a reduction of 31% from 1983 levels, roughly the same as for the 1979 to 1986 period.

Some tampering results were reported in 1983, and showed that 19% of EGR valves and 2% of catalytic converters were not functional, almost the reverse of 1986 results[3]. No tampering results were reported in 1979.

7. Conclusions

Emission testing of 222 vehicles showed that 64% were within the CO guideline values at idle for the appropriate year vehicle, while 86% were within the HC guideline values. Similarly, 78% of the vehicles were within CO guidelines at 2500 rpm, and 97% were lower than the HC guideline values. These percentages are not comparable to results from earlier test clinics, since different guideline values were likely used.

The average CO emission at idle was 2.1%, representing about a 30% drop from 1979 and 1983 results. Average HC emissions were 315 ppm, down about 17% from 1979 levels. CO emissions at 2500 rpm were slightly higher than in 1979, while HC emissions were 28% lower.

The most common form of tampering involved removal of carburetor limiter caps and plugs on the idle mixture screws, followed by

removal or disablement of air injection systems and catalytic converters. Other forms of tampering were observed to be low.

In total, 38% of vehicles were observed to have been tampered with, although the actual percentage may have been higher had there been more time available to carry out further testing of pollution control devices.

The test clinic was well received by the public. A high level of participation was achieved due in part to a successful advertising campaign.

8. Acknowledgements

The sponsors would like to thank Mr. Gerry Doiron and the management of Midway Chrysler Ltd. for their assistance and participation in the clinic.

We would also like to thank the City of Winnipeg Traffic Department for the loan of barricades and pylons.

The cooperation of Grant Park Plaza in providing a site for the test clinic is also gratefully acknowledged.

9. References

1. "I/M Techline", U.S. E.P.A. Newsletter, Mobile Source Division, February 1986.

2. "1979 Manitoba Idle Emission Test Program", Air Pollution Control Section, Environmental Management Division, 1979.

3. "A Report with Recommendations for the Reduction of Emissions from In-Use Light Duty Motor Vehicles", Transportation Systems Division, Environment Canada, IP-34, May 1985.

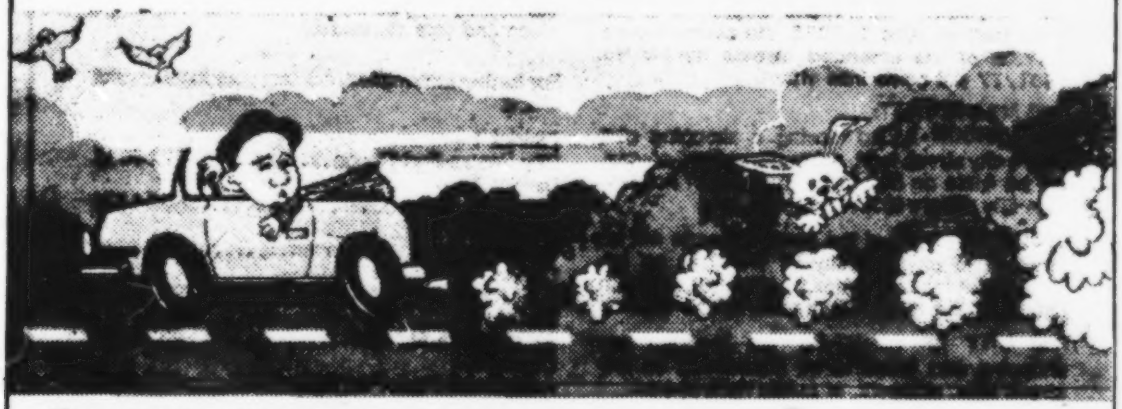
APPENDIX A

WINNIPEG FREE PRESS AD

May 31, 1986

FREE
VEHICLE EXHAUST TEST

WHEN:	**June 2**	**June 3, 4 & 5**
	Noon to 5 p.m.	9 a.m. to 4 p.m.
WHERE:	Grant Park Plaza	



When your car isn't operating efficiently, you're wasting fuel and polluting the air. Our free, no obligation exhaust test will tell you whether your car is properly tuned for optimal fuel economy.
Sponsored by the organizing committee for Canadian Environment Week.

Wpg Ft 86105

CANADIAN ENVIRONMENT WEEK

SEMAINE CANADIENNE DE L'ENVIRONNEMENT

PRESS RELEASE

WINNIPEG (June 2, 1986) -- Winnipeg motorists will be able to give their cars a "breath test" from June 2 to 5 at a free, no obligation vehicle exhaust testing clinic at Grant Park Plaza.

Technicians on site will make a quick test of your vehicle's exhaust to determine if your car is properly tuned to make the best use of energy. When your car isn't operating efficiently, you're wasting fuel and polluting the air.

The clinic will open at noon on June 2, and will operate daily from 9 to 4 until June 5. Sponsored by Environment Canada, and the Manitoba Department of Environment, Workplace Safety and Health, the vehicle testing clinic is part of Canadian Environment Week celebrations.

-30-

Contact: T. Youmans
949-4814

L. Strachan
945-7071

CJOB/68 CKIS 97fm
930 PORTAGE AVENUE WINNIPEG MANITOBA R3G 0P8 (204)786-2471

radio copy

Client ..... Envir. CDA - Exhaust Test ... #1 .....

Time ..... 30 ..... Writer ..... KLK .....

Broadcast Dates . June 1 - 4 /86 ..... 19___

CRTC # ..... WT .....

Does your car have bad breath? When your car isn't operating efficiently, you're not only polluting the air, you're also wasting gas! You can test your car's "breath" at the free vehicle exhaust test clinic at Grant Park Plaza. The clinic is open (~~tomorrow~~ from noon to 5,) and (~~Tuesday~~ through Thursday) (today through Thursday,) (today and tomorrow,) (today, from 9 to 4. This free, no obligation exhaust test will tell you whether your car is properly tuned to make the best use of energy. So, bring your car into the free vehicle exhaust test clinic now. Sponsored by the organizing committee for Canadian Environment Week.

58 CKY
STEREO WINNIPEG

CLIENT ENVIRONMENT CANADA DATE JUNE 1 - 4/86

WRITER MARCELLE NUMBER 314

When your car isn't operating efficiently, you're not only polluting the air, but also wasting gas. A free vehicle exhaust test clinic is offered till Thursday at Grant Park Plaza. This no obligation exhaust test will tell you whether your car is properly tuned to make the best use of energy. Take this opportunity to find out if your car has bad breath. Take it to the free vehicle exhaust test clinic at Grant Park Plaza Monday from noon to 5 and Tuesday to Thursday from 9 to 4. This clinic is sponsored by the organizing committee for Canadian Environment Week!

APPENDIX B

DATE:

1–4 ID NUMBER

5–8 MAKE

9–12 MODEL

13 __ VEHICLE TYPE (1-Car, 2-Truck A, 3-Truck B)

14 15 __ __ LICENCE PLATE (Provinc:)

Low Idle _ _ _ _ rpm High Idle _ _ _ _ rpm

16–19 __ __ __ __ HC, PPM _ _ _ _

20–23 __ __ __ __ CO, % _ _ _ _

24 __ PLUMBTESMO (Positive, Negative)

25–27 __ __ __ ODOMETER READING, Thousand
__ Km __ Miles

28 __ DASH LABEL (0, 1, 7)

29 __ TANK CAP (1, 7, 9)

30 __ TANK LABEL (0, 1, 7)

31 __ FUEL INLET RESTRICTOR (0, 1, 4, 7)

32 __ CAT (0, 1, 7, 9)

__ CAT 2 (1=both, 2=oxidation only, 3=3-way)

33 __ EXHAUST SYSTEM (P-stock, N-non)

34 __ EXHAUST INTEGRITY (1, 9)

35 __ FUEL SAMPLE (Y=Yes, N=No)

__ TRANSMISSION (1=M4, 2=M5, 3=A3, 4=A4, 6=other)

__ FUEL INJECTION (Y=Yes, N=No)

__ COMPUTER FEED BACK SYSTEM (Y=Yes, N=No)

__ U.S.A. SPECIFICATION VEHICLE (Y=Yes, N=No)

0 - Not Original Equipped
1 - Functioning Properly
2 - Electrical Disconnect
3 - Vacuum Disconnect
4 - Mechanical Disconnect
5 - Incorrectly Routed Hose
6 - Non-Stock
7 - Missing Item
8 - Misadjusted Item
9 - Malfunctioning

_____
INSPECTOR NAME

_____
LOCATION

REAR OF VEHICLE SURVEY FORM NO. 1

DATE:

1---4 ID NUMBER

5 EGR VALVE (0, 1, 3, 7, 9)

6 EGR SENSOR (0, 1, 3, 5, 7, 9)
(CTO-Transducers-Other)

7 8 MODEL YEAR

9---12 DISPLACEMENT (CID or liters)

13----------23 ENGINE FAMILY

24----------36 VIN

37 CAT EQUIPPED (1-Yes; 2-No; 3-Can't Tell)

38 AIR CLEANER (P-Stock; 6-Non)

39 HEATED AIR INTAKE (0, 1, 3, 4, 6, 7, 9)

40 PCV (0, 1, 3, 4, 6, 7)

41 TURBO (0, P-Stock, 6-Non, A-Add-on)

42 EVAP. (0, 1, 3, 4, 5, 7, 9)

43 AIR PUMP (0, 1, 4, 7, 9)

44 AIR PUMP BELT (0, 1, 7, 8)

45 P.A.I.R. (0, 1, 4, 7, 9)

46 INTAKE MANIFOLD (P, 6)

47 EXHAUST MANIFOLD (P, 6)

48 O_2 SENSOR (0, 1, 2, 4, 7)

49 DISTRIBUTOR (P, 6)

50 VACUUM SPARK RETARD (0, 1, 2, 3)

__ CARBURETOR TYPE
(P, Sealed, Fuel Injection, 6)

__ CARBURETOR, NUMBER OF BARRELS (0, 1, 2, 4)

51 IDLE STOP SOLENOID (0, 1, 2, 7, 9)

53 LIMITER CAP (0, 1, 4, 7, 8-Sealed Plugs Removed)

FRONT OF VEHICLE SURVEY FORM NO. 2

0 - Not Original Equipped
1 - Functioning Properly
2 - Electrical Disconnect
3 - Vacuum Disconnect
4 - Mechanical Disconnect
5 - Incorrectly Routed Hose
6 - Non-Stock
7 - Missing Item
8 - Misadjusted Item
9 - Malfunctioning
P - Stock

INSPECTOR NAME

LOCATION

APPENDIX C

SUGGESTED EXHAUST EMISSIONS TEST LIMITS**

	2 500 RPM				IDLE			
	6 & 8 Cylinder		4 Cylinder		6 & 8 Cylinder		4 Cylinder	
Vehicle Age	CO %	HC ppm	CO %	HC ppm	CO %	HC ppm	CO %	HC ppm
0-1***	1.0	200	1.5	200	1.5*	300	2.5*	300
1	1.1	230	1.6	230	1.6	330	2.6	330
2	1.2	260	1.7	260	1.7	360	2.7	360
3	1.3	290	1.8	290	1.8	390	2.8	390
4	1.4	320	1.9	320	1.9	420	2.9	420
5	1.5	350	2.0	350	2.0	450	3.0	450
6	1.6	380	2.1	380	2.1	480	3.1	480
7	1.7	410	2.2	410	2.2	510	3.2	510
8	1.8	440	2.3	440	2.3	540	3.3	540
9 etc.	1.9	470	2.4	470	2.4	570	3.4	570

* The existing MVSA new vehicle emission standards for the idle test.
** To be used if the manufacturer's specifications are not available.
*** Present model year.

(from Vehicle Emissions and Pollution Control Equipment Inspection Clinic, Information Package, EPS Draft Report, May 5, 1986)

APPENDIX D

YOUR TEST RESULTS

EXHAUST EMISSION LEVELS:

	LOW	MODERATE	HIGH
HYDROCARBONS (HC)	☐	☐	☐
CARBON MONOXIDE (CO)	☐	☐	☐

POSSIBLE REASONS FOR HIGH EMISSION LEVELS

HYDROCARBON EMISSIONS CONSIST PRIMARILY OF UNBURNED GASOLINE.

High Hydrocarbon emissions may be caused by:

1) Ignition system problems (timing, spark plugs, plug wires, coil, electronic spark control, etc.).
2) Vacuum leak(s) in engine
3) Faulty PCV system
4) Idle mixture too lean
5) Carbon deposits in engine
6) Worn engine
7) Faulty EGR valve operation
8) Faulty air injection system
9) Faulty catalytic converter

CARBON MONOXIDE EMISSIONS RESULT FROM THE IMCOMPLETE BURNING OF GASOLINE.

High Carbon Monoxide emissions may be caused by:

1) Dirty air filter
2) Plugged PCV system
3) Idle mixture too rich
4) Carburetor, fuel or injection system maladjustment or malfunction
5) Faulty air injection system
6) Faulty catalytic converter.

IF YOUR CAR HAS HIGH LEVELS OF EMISSIONS, WE SUGGEST THAT YOU HAVE IT CHECKED OUT AT A SERVICE OUTLET THAT IS FAMILIAR WITH THE PROPER MAINTENANCE AND OPERATION OF YOUR CAR, INCLUDING THE EMISSION CONTROL SYSTEMS. A WELL-TUNED CAR NOT ONLY RUNS BETTER, BUT GETS BETTER FUEL ECONOMY. IT ALSO REDUCES EMISSIONS OF HARMFUL AIR POLLUTANTS TO THE ENVIRONMENT.